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MONTHLY WEIGHT AND BALANCE REPORT

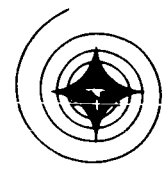
FOR THE APOLLO SPACECRAFT

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1 AUGUST 1963



Prepared by

Weight Control

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NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

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~~CONFIDENTIAL~~INTRODUCTION

The August report reflects a spacecraft weight increase of 215 pounds at injection and 90 pounds at Service Module burnout.

The major changes in the Command Module were due to the incorporation of the two point parachute attach design, and an increase in strake structure resulting from antenna relocation.

The major changes in the Service Module were due to the decrease in structure based on current calculations and an increase in the electrical power fuel cell power pack.

The major changes in the Launch Escape System were due to an increase in the tower separation system and increased ballast weight consistent with combined Command Module and Launch Escape System balance requirement.

The potential changes have been revised to include the weight reduction associated with a ten day duration in lieu of a 14 day duration for the LOR Mission while retaining alternate mission capabilities for 14 day duration.

The current injected weight of 84,095 pounds is based on the Service Module loaded with sufficient propellant at a specific impulse of 313.0 to provide 10 per cent ΔV margin. This is based on LEM weight, including crew, of 25,000 pounds.

The earth orbital mission weight summary reflects a two stage booster-to-orbit injection without the use of Service Module propulsion and is based on a complete Service Module loaded with 2,435 pounds of propellant.

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APOLLO LOR MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. ²)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9400	1042.8	-0.2	7.9	4260	3708	3540
SERVICE MODULE - Less Propellant	9725	908.4	0.7	-0.6	6337	10245	10068
TOTAL - Less Propellant	19125	974.5	0.3	3.6	10672	32663	32244
PROPELLANT - S/M**	37400	905.7	5.5	-2.3	19400	20300	26200
TOTAL - With Propellant	56525	929.0	3.7	-0.3	30241	65970	71432
LUNAR EXCURSION MODULE	24460	623.0	0.0	0.0	13616	12776	13247
ADAPTER - LEM - C-5	3110	640.1	0.0	0.0	6991	8599	8599
TOTAL - Injected	84095	829.3	2.5	-0.2	50904	457281	463270
LAUNCH ESCAPE SYSTEM	6600	1294.8	0.0	-0.1	249	9191	9194
TOTAL - Spacecraft Launch	90695	863.2	2.3	-0.2	51162	752717	758716

NOTES: *Center of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

**The propellant weight of 37400 pounds provides approximately 10% ΔV margin, and excludes 210 pounds of ΔV propellants tanked in the service module reaction control system. The propellant weight is based on a specific impulse of 313.0.

APOLLO EARTH ORBIT MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. ²)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9400	1042.8	-0.2	7.9	4260	3708	3540
SERVICE MODULE - Less Propellant	9725	908.4	0.7	-0.6	6337	10245	10068
TOTAL - Less Propellant	19125	974.5	0.3	3.6	10672	32663	32244
PROPELLANT - S/M**	2435	849.0	27.0	-11.7	770	500	600
TOTAL - With Propellant	21560	960.3	3.3	1.9	11884	40610	40516
ADAPTER - C-1	830	779.7	0.0	0.0	1029	753	753
TOTAL - Injected	22390	953.6	3.2	1.8	12915	46985	46897
LAUNCH ESCAPE SYSTEM	6600	1294.8	0.0	-0.1	249	9191	9194
TOTAL - Spacecraft Launch	28990	1031.3	2.4	1.4	13179	184276	184194

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line.

**The earth orbital weights are based on a complete service module and includes 2435 pounds of propellant for an orbital altitude of about 104 nautical miles with a payload launch azimuth of 72°.

APOLLO LAUNCH ABORT CONFIGURATION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. ²)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9400	1042.8	-0.2	7.9	4260	3708	3540
LAUNCH ESCAPE SYSTEM	6600	1294.8	0.0	-0.1	249	9191	9194
TOTAL - Launch Abort	16000	1146.8	-0.1	4.6	4563	66101	65882
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3210	1296.5	0.0	0.0	-69	-1330	-1330
TOTAL - LES Burnout	12790	1109.2	-0.1	5.8	4475	45316	45115

NOTE: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LUNAR ORBIT RENDEZVOUS MISSION

VEHICLE MODE	WEIGHT	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT ²)					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
EARTH LAUNCH	9400	1042.8	-0.2	7.9	4260	3708	3540	23	-184	-36
ADJUSTMENTS (NET)	+65									
Boost & Mission Coolants										
Food & Water Consumption										
Mission Waste Pickup										
Fuel Cell Water Pickup										
PRIOR TO ENTRY	9465	1042.4	-0.2	7.9	4309	3742	3582	37	-201	-23
Less: Propellant	-258	1022.6	-6.2	56.6						
Ablator Burnoff	-223	1019.7	0.0	11.2						
Entry Coolant	-6	1022.5	-21.1	61.8						
Forward Heat Shield	-364	1100.0	0.0	1.9						
Drogue Chute	-25	1090.0	11.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	8589	1041.0	-0.1	6.7	3878	3104	3043	28	-111	-19
Less: Main Chutes (3)	-440	1089.9	0.3	6.7						
LANDING	8149	1038.4	-0.1	6.7	3833	2846	2766	26	-111	-19

NOTE: Mass inertia data is shown for accumulative totals only.

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COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

HIGH ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT ²)					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
EARTH LAUNCH	9400	1042.8	-0.2	7.9	4260	3708	3540	23	-184	-36
Less: Boost Coolants	-14	1019.4	-38.9	1.4						
PRIOR TO ENTRY	9386	1042.8	-0.1	7.9	4250	3702	3533	20	-185	-38
Less: Propellant	-258	1022.6	-6.2	56.6						
Ablator Burnoff	-112	1019.7	0.0	11.2						
Entry Collant	-6	1022.5	-21.1	61.8						
Forward Heat Shield	-364	1100.0	0.0	1.9						
Drogue Chute	-25	1090.0	11.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	8621	1041.2	-0.1	6.7	3869	4017	3036	11	-95	-34
Less: Main Chutes (3)	-440	1089.9	0.3	6.7						
LANDING	8181	1038.6	-0.1	6.7	3826	2851	2762	9	-95	-34

NOTE: Mass inertia data is shown for accumulative totals only.

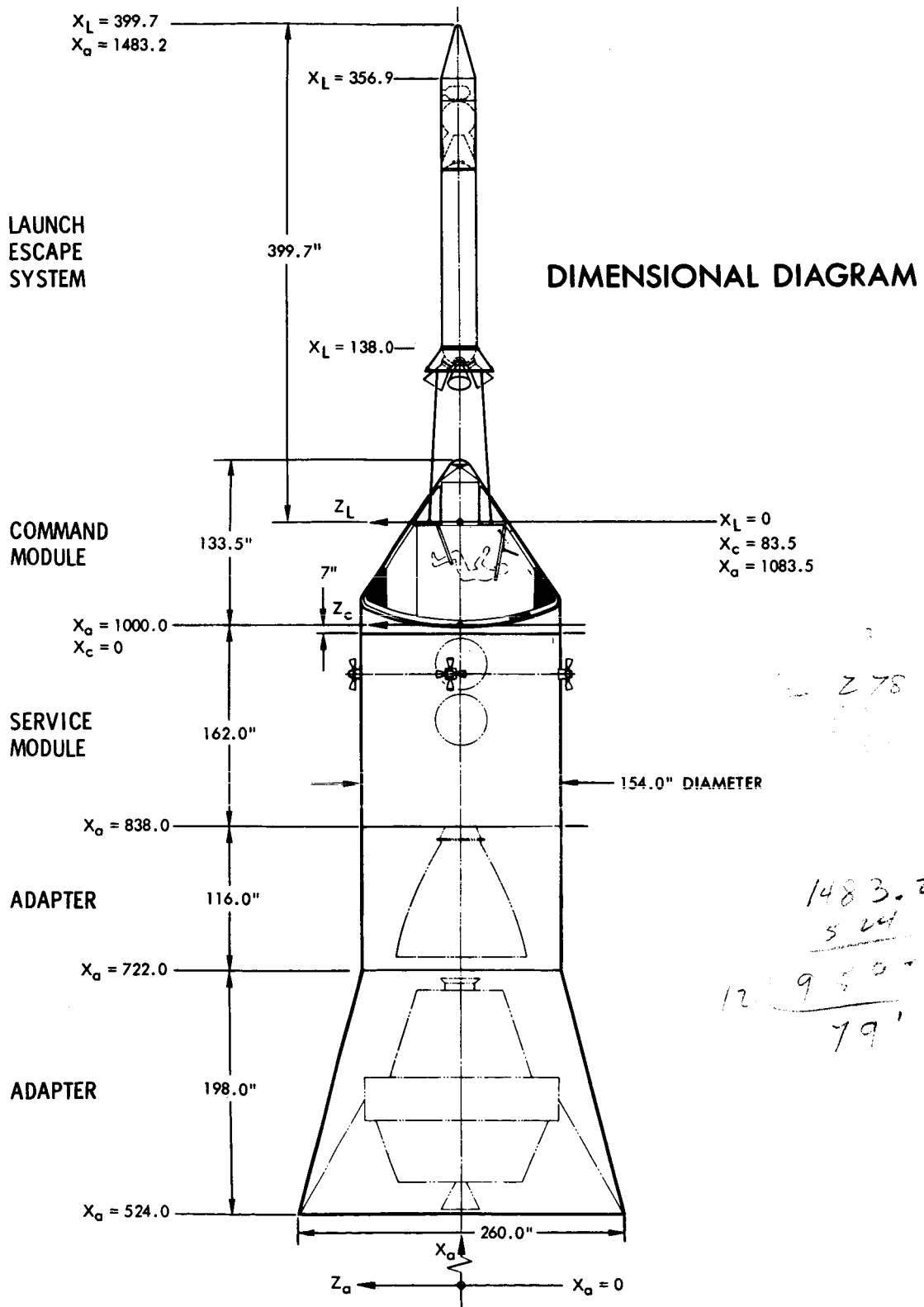
COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LOW ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT. ²)						
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz	
EARTH LAUNCH	9400	1042.8	-0.2	7.9	4260	3708	3540	23	-184	-36	
Less: Propellant	-258	1022.6	-6.2	56.6							
Forward Heat Shield	-375	1097.8	-0.3	3.2							
Drogue Chute	-25	1090.0	11.0	-22.0							
PRIOR TO MAIN CHUTE DEPLOYMENT	8742	1040.9	-0.1	6.8	3985	3231	3153	15	-105	-34	
Less: Main Chutes (3)	-440	1039.9	0.3	6.7							
LANDING	8302	1038.3	-0.1	6.8	3940	2972	2875	13	-105	-34	

NOTE: Mass inertia data is shown for accumulative totals only.

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~~CONFIDENTIAL~~SPACECRAFTWEIGHT STATUS SUMMARY

ITEM	PREVIOUS STATUS 7-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 8-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
COMMAND MODULE	9310	+90	9400	63	35	2
SERVICE MODULE	47000	+125	47125	5	95	-
LES	6560	+40	6600	33	59	8
ADAPTER	3110		3110	100		
TOTAL	65980	+255	66235	20	79	1

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COMMAND MODULE WEIGHT STATUS

ITEM	PREVIOUS STATUS 7-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 8-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure Structure - Less Ablator Ablation Material	(4382) 3105 1277	(+99) +99	(4481) 3204 1277	41 100	59	
Crew Systems	327	- 7	320	95	5	
Communication and Instrumentation	754	- 7	747	100		
Guidance and Navigation	476	+ 2	478	100		
Stabilization and Control	209		209	100		
Reaction Control	290		290	84	16	
Electrical Power	430	- 3	427	96	4	
Environmental Control	293	- 1	292	80	20	
Earth Landing	559	+ 8	567	11	64	25
WEIGHT EMPTY						
Crew (3), (50, 70, 90 percentile)	7720	+91	7811	68	30	2
Crew System Equipment	528		528		100	
Food and Containers	299		299	93	3	4
Reaction Control Propellant	90		90	100		
Environmental Control Chemicals	259		259		100	
Scientific Payload	164	-1	163		100	
	250		250	100		
GROSS WEIGHT	9310	+90	9400	63	35	2

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~~CONFIDENTIAL~~COMMAND MODULECURRENT WEIGHT EMPTY CHANGES

STRUCTURE	(+99.0)
Increase basic body structure forward section due to the following:	+11.0
Addition of pads to forward bulkhead face sheet to accommodate new side load fittings caused by parachute attach relocation.	+11.0
Increase in forward ring of forward cylinder, due to two point parachute attach and increased parachute loads.	+8.0
Increase of forward hatch due to increased parachute loads.	+3.0
Deletion of four parachute fittings and addition of four heat shield ejection piston support fittings.	-8.0
Deletion of drogue chute fittings and pilot chute support tees as these fittings will be included in the earth landing system.	-15.0
Addition of parachute attach fittings required to transmit side loads into surrounding structure.	+12.0
Increase basic body structure center section due to the following:	+50.0
Increase in longerons due to the incorporation of the two point parachute attach system resulting in higher loads.	+46.0
Addition of stringers on either side of hatch to beam loads and to tie inner structure to outer structure.	+4.0
Increase secondary structure based on revised estimates of current layouts.	+5.0
Increase heat shield substructure due to expanding the forward strake area, "beefing up" the aft strake, relocating antenna, also adding ablation at the base of the strake.	+27.0
Increase insulation due to calculation of preliminary drawings of crew compartment.	+6.0

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~~CONFIDENTIAL~~COMMAND MODULECURRENT WEIGHT EMPTY CHANGES

CREW SYSTEM	(-7.0)
Delete nuclear radiation detectors as this requirement is accomplished in the Communication and Instrumentation System.	-7.0
COMMUNICATION & INSTRUMENTATION	(-7.0)
Increase PCM telemetry based on Collins status report reflecting a change from 32- kilobit to 51.2- kilobit system.	+7.0
Increase recorder based on data received from Leach.	+3.4
Increase premodulation processor based on Collins status report.	+1.2
Increase C-band transponder based on Collins status report.	+0.3
Increase TV camera due to requirement change allowing complete interchangeability between the Apollo Command Module and the LEM by the addition of a common sync generator in lieu of timing inputs from the central timing equipment.	+1.0
Decrease antennas and transmission based on revised antenna weights and calculation of current transmission lines.	-8.9
Decrease controls and displays based on analysis of revised controls and displays.	-10.0
Decrease electrical provisions due to removal of three timing cables from the TV camera to the central timing equipment as a result of adding a common sync generator to the TV camera.	-1.0
GUIDANCE & NAVIGATION	(+2.0)
Increase G & N system due to incorporation of MIT June status as follows:	+2.0
Display & Control - Navigation	+2.5
Loose Stored Items	-0.5

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~~CONFIDENTIAL~~COMMAND MODULECURRENT WEIGHT EMPTY CHANGES

ELECTRICAL POWER (-3.0)

Add PLSS battery charging control to insure that the PLSS battery electrically disconnects from the Apollo battery circuit when the voltage reaches 22 volts. +1.0

Decrease A-C power box assembly, battery circuit breaker panel, electrical transmission and left-hand circuit breaker panel, due to revised calculations of current drawings. -4.0

ENVIRONMENTAL CONTROL (-1.0)

Increase pressure suit circuit due to analysis of current drawings reflecting additional ducting. +1.4

Decrease oxygen supply system due to the addition of a surge tank to the ECS and the deletion of the entry O₂ supply. This change provides early mission emergency gas flows without placing the cryogenic storage system in a two-phase condition and affects weight as follows: -6.7

Subcontractor Re-entry O ₂ Supply System	-13.8
Valves (2)	+0.8
Oxygen Surge Tank	+6.3

Increase water system plumbing on revised calculations. +3.3

Increase O₂ system plumbing based on revised calculations. +1.0

EARTH LANDING SYSTEM (+8.0)

Add drogue chute fittings and pilot chute support tees formerly included in structure. +15.0

Decrease attach fittings due to change in number required from four to two. -7.0

TOTAL COMMAND MODULE CURRENT WEIGHT EMPTY CHANGES +91.0

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~~CONFIDENTIAL~~COMMAND MODULECURRENT USEFUL LOAD CHANGES

Increase re-entry O ₂ based on requirements of surge tank design.	+1.7
Delete earth orbit drinking water based on current requirements.	-4.0
Delete mission cooling water based on current requirements.	-5.5
Add water for initial charge of one portable life support system.	<u>+6.8</u>
TOTAL COMMAND MODULE CURRENT USEFUL LOAD CHANGES	-1.0

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SERVICE MODULE WEIGHT STATUS

ITEM	PREVIOUS STATUS 7-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 8-1-63	BASIS FOR CURRENT		
				% EST	% CAL	% ACT
Structure	2310	-20	2290	17	73	10
Electronics	177		177	100		
Reaction Control	590		590	69	31	
Electrical Power	1307	+25	1332	27	68	2
Environmental Control	104	-5	99	38	58	4
Propulsion System Engine Installation Propulsion System	(3007) 690 2317		(3007) 690 2317	85 15	15 85	
WEIGHT EMPTY	7495	0	7495	31	66	3
RCS Propellant	838		838		100	
Electrical Power Supercritical Fluids	503		503		100	
Environmental Control Supercritical Fluids	208		208		100	
Main Propulsion Helium	99		99		100	
Main Propellant Residuals	(582)		(582)		100	
Trapped - System	225		225			
Trapped - Engine	67		67			
Mixture Ratio Tolerance	100		100			
Loading Tolerance	190		190			
BURNOUT WEIGHT	9725	0	9725	24	74	2
Main Propellant	37275	+125	37400		100	
GROSS WEIGHT	47000	+125	47125	5	95	

~~CONFIDENTIAL~~SERVICE MODULECURRENT WEIGHT EMPTY CHANGES

STRUCTURE	(-20.0)
Decrease basic body structure due to the following:	-13.0
Decrease of outer shell honeycomb panel core density from 3.0 lbs./cubic feet to 2.3 lbs./cubic feet.	-20.0
Decrease in cross sectional area of closeouts in outer shell honeycomb panel based on released drawing.	-4.0
Deletion of access door doubler from the outer shell honeycomb panel.	-1.0
Decrease of radial beam machined webs due to partial actual weights in lieu of calculations.	-13.0
Decrease of internal structure and engine compartment closeouts due to calculated weights in lieu of estimates.	-2.0
Increase of aft bulkhead face sheet thickness in the area of the fuel cells and hydrogen tank mounts and the addition of lands for mounting of the aft heat shield.	+14.0
Increase in density of the aft bulkhead honeycomb core in Sector I and Sector IV from 1.6 lbs./cubic ft. to 2.3 lbs./cubic ft. due to increased loads from the fuel cells and hydrogen tanks.	+3.0
Increase in density of the aft bulkhead honeycomb core from 7.9 lbs./cubic ft. to 10.5 lbs./cubic ft. due to load increase in the oxidizer tank sector.	+10.0
Decrease in separation provisions due to incorporating calculated in lieu of estimated weights.	-4.0
Decrease of Command Module to Service Module umbilical fairing due to revised estimate based on prerelease drawings.	-3.0

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~~CONFIDENTIAL~~SERVICE MODULECURRENT WEIGHT EMPTY CHANGES

ELECTRICAL POWER SYSTEM	(+25.0)
Increase fuel cell power system due to the following:	+25.9
Increase in fuel cell power pack as anticipated weight reductions previously reported by Pratt & Whitney have not materialized. However, the weight reduction will be carried as a potential.	+33.0
Decrease of fuel cell H ₂ system subcontractor components based on Beech's May Weight Report.	-1.4
Decrease of fuel cell O ₂ system subcontractor components based on Beech's May Weight Report.	-1.1
Increase in fuel cell module stabilization webs due to an increase in number of standard parts.	+1.4
Deletion of valve module control box consistent with current requirements for the environmental control system.	-6.0
Decrease of electrical common utility due to calculated weights of electrical transmission supports and miscellaneous design changes.	-0.9
ENVIRONMENTAL CONTROL SYSTEM	(-5.0)
Increase of water glycol plumbing and hardware based on calculated in lieu of estimates.	+4.0
Decrease of space radiator outer skin due to an increase in the chem-milled area of the radiator.	-11.0
Increase in plumbing supports due to the addition of supports which are utilized for a combination of systems.	<u>+2.0</u>
TOTAL SERVICE MODULE CURRENT WEIGHT EMPTY CHANGES	0

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~~CONFIDENTIAL~~LAUNCH ESCAPE SYSTEMWEIGHT STATUS

ITEM	PREVIOUS STATUS 7-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 8-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure	978	+33	1011		100	
Electrical System	41		41	100		
Propulsion System						
Main Thrust	4764		4764	40	60	
Jettison	434		434			100
Jettison Motor						
Skirt	92		92			100
Pitch Control	55		55	60	40	
LES - NO BALLAST	6364	+33	6397	31	61	8
BALLAST	196	+7	203	100		
TOTAL L.E.S.	6560	+40	6600	33	59	8

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~~CONFIDENTIAL~~LAUNCH ESCAPE SYSTEMCURRENT WEIGHT CHANGES

STRUCTURE

(+33)

Increase tower assembly due to the incorporation of a redundant separation system for the Launch Escape Tower to Command Module disconnects. This system is designated as a flexible linear shaped charge device.

+33

BALLAST

(+7)

Increase ballast consistent with combined Command Module and Launch Escape System balance requirements.

+7

TOTAL LAUNCH ESCAPE SYSTEM CURRENT WEIGHT CHANGES

+40

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ADAPTER
WEIGHT STATUS

ITEM	PREVIOUS STATUS 7-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 8-1-63	BASIS FOR CURRENT		
				%EST	%CAL	%ACT
Structure	2892		2892			
Electrical	76		76			
Separation System	142		142			
TOTAL ADAPTER	3110		3110	100		

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~~CONFIDENTIAL~~WEIGHT HISTORY COMMENTS

LAUNCH ESCAPE SYSTEM

The target weight established for the LES is 6,300 pounds, excluding ballast. This weight was based on the September 1962 status weight of 6,600 pounds, including the necessary ballast to provide currently determined aerodynamic stability to prevent tumbling.

The original target of 5,900 pounds, as reported in the June Status, SID 62-99-5, was based on an attitude controlled configuration. The current configuration weight includes a pitch motor and ballast not included in the original target weight.

COMMAND MODULE

The target weight established for the Command Module is 8,500 pounds. An estimated weight breakdown for the target weight is provided for comparative purposes.

The original target weight of 8,340 pounds, as reported in the June Status, SID 62-99-5, did not include the proposed increases nor the Category I reductions presented in the July briefing and incorporated in the July Status Report.

SERVICE MODULE

The target weight established for the Service Module less usable propellant is 11,000 pounds. An estimated weight breakdown for the target weight is provided for comparative purposes. This configuration is sized for 45,000 pounds usable propellant for the 25,000 pound LEM.

The original target weight of 8,595 for the burnout condition was based on a lunar landing configuration sized for 31,000 pounds usable propellant.

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~~CONFIDENTIAL~~WEIGHT HISTORYCOMMAND MODULE

	ORIGINAL TARGET WT.	TARGET WEIGHT	AUTHORIZED CHANGES	AUTHORIZED WEIGHT 8-1-63
Structure	3774	3824		3824
Crew Systems	405	530		530
Communication & Instrumentation	874	715	+35	750
Guidance & Navigation	310	310	+168	478
Stabilization & Control	161	181		181
Reaction Control	183	195		195
Electrical Power	354	390	+10	400
Environmental Control	208	235	+2	237
Earth Landing	530	610		610
WEIGHT EMPTY	6799	6990	+215	7205
Crew	528	528		528
Suits & Personal Equipment	296	304		304
Food & Containers	90	90		90
Reaction Control Propellant	210	210		210
Environmental Control Fluids	167	128		128
Scientific Payload	250	250		250
GROSS WEIGHT	8340	8500	+215	8715

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~~CONFIDENTIAL~~COMMAND MODULE WEIGHT HISTORYWEIGHT EMPTY AUTHORIZED CHANGES

COMMUNICATIONS & INSTRUMENTATION	(+35)
Add a spacecraft up-data link for the purpose of providing current GOSS data within the spacecraft for display and comparison with the on-board computed data. (CCA No. 54).	
	+35
GUIDANCE & NAVIGATION	(+168)
Increase the Guidance and Navigation per recent weight report from M.I.T. Since NAA does not have weight control responsibility for the M.I.T. design, the weight changes in their Weight and Balance Report will be considered as authorized changes.	
	+168
ELECTRICAL POWER	(+10)
Add two batteries to provide a source of power, separate from the primary D.C. power, to initiate pyrotechnic devices. (CCA No. 28)	
	+10
ENVIRONMENTAL CONTROL	(+2)
Add a CO ₂ sensor to the ECS as a part of the ECS operational instrumentation. (CCA No. 43)	
	<u>+2</u>
TOTAL COMMAND MODULE WEIGHT EMPTY CHANGES	+215

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~~CONFIDENTIAL~~WEIGHT HISTORYSERVICE MODULE

	ORIGINAL TARGET WT.	TARGET WEIGHT	AUTHORIZED CHANGES	AUTHORIZED WEIGHT 8-1-63
Structure	2810	3203		3203
Electronics	216	145		145
Reaction Control	254	737		737
Electrical Power	1076	1203		1203
Environmental Control	413	250		250
Propulsion System				
Engine Installation	375	606		606
Propellant System	1928	2456		2456
WEIGHT EMPTY	7072	8600		8600
Usable RCS Propellant	400	611		611
Usable Fuel Cell Reactants	380	479		479
Environmental Control Fluids	288	193		193
Main Propulsion Helium	97	139		139
Main Prop. Residuals	300	900		900
Unusable RCS Propellant	20	61		61
Unusable Fuel Cell Reactants	38	17		17
BURNOUT WEIGHT	8595	11000		11000
Main Propellant	31000	45000		45000
GROSS WEIGHT	39595	56000		56000

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~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESCOMMAND MODULE

STRUCTURE	(+34)
Addition of pitch motor support structure and new gusset attach fittings.	+12
Addition of co-axial fittings and liquid waste overboard fitting.	+3
Replace inner to outer attach "I" section with a slip stringer consisting of a tee and clevis.	+27
Decrease window weight based on a reduction in area from original estimate.	-8
CREW SYSTEMS	(-38)
Increase portable life support system per Hamilton Standard letter to NASA.	+36
Delete one portable life support system as analysis of current requirements indicate that only one is required in the Command Module for the lunar mission.	-48
Remove water from remaining PLSS	-5
Increase radiation dosimeter per new NASA weights.	+11
Remove primary O ₂ from remaining PLSS	-1
Increase suit wiring and umbilicals.	+3
Remove food and personal preference items from survival kit.	-5
Increase portable light assembly due to refined design criteria.	+2
Decrease mission length from 14 days to 10 days:	-31
Food and container	-26
Chemical disinfectant	-1
Personal hygiene equipment	-4
COMMUNICATION & INSTRUMENTATION	(+26)
Add electrical provisions for test instrumentation to monitor C-1 and C-5 booster per NASA.	+16
Add provisions for FQ PCM.	+10

~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESCOMMAND MODULE

REACTION CONTROL SYSTEM	(+35)
Add Command Module reaction control propellant disposal system. This system is designed to dispose of the Command Module propellant prior to impact to eliminate potential explosion.	
	+35
ELECTRICAL POWER SYSTEM	(-8)
Change aft compartment electrical feed thru to aluminum.	
	-8
ENVIRONMENTAL CONTROL SYSTEM	(-85)
Delete regenerative heat exchanger.	
	-7
Decrease water-glycol plumbing weight due to analysis reflecting possible wall thickness reduction from .035 to .020 inches.	
	-3
Addition of N ₂ purge system for forward and aft compartment.	
	+5
Relocate suit umbilical control connections.	
	-7
Delete Freon system and associated changes.	
	-13
Reduce LiOH, charcoal and containers/astronaut data and compatible RQ	
	-13
Reduce LiOH, charcoal and containers for 10 day mission.	
	-47
EARTH LANDING SYSTEM	(+72)
Increase main cluster harness due to two point attachment.	
	+29
Addition of second drogue chute installation.	
	+43
LEM INTEGRATION	(+195)
Modify structure to incorporate mating and locking capabilities and to strengthen hatch for mating impact loads.	
	+145
Add rendezvous beacon radar installation as an aid during the rendezvous phase.	
	+50
TOTAL POTENTIAL WEIGHT CHANGES COMMAND MODULE	+239

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~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESSERVICE MODULE

STRUCTURE		(-40)
Add provisions for nitrogen purging of the Service Module to prevent accidental explosion on the pad.		+15
Replace aluminum honeycomb sandwich in aft heat shield with stiffened fiberglass sheet.		-55
REACTION CONTROL SYSTEM		(+35)
Increase system for incorporation of provisions for RCS propellant quantity indication.		+35
ELECTRICAL POWER		(-304)
Revise the Supercritical Gas Storage System, based on co-ordination with the subcontractor (Beech Aircraft), to include the following changes:		-60
Reduction of insulation preloading from 2 to $\frac{1}{2}$ psi, H ₂ tank.	-7	
Aluminum skirt for H ₂ tank in lieu of titanium.	-3	
Fan heaters in lieu of electrofilm heaters cryogenic system.	-14	
Signal conditioners - redirected design-cryogenic system.	-5	
Magnetic latching fuel cell valves.	-3	
Aluminum oxygen disconnect valve in lieu of steel.	-2	
Reduction of oxygen tank pressure from 900 to 800 psi.	-8	
Sculpturing material on complete system	-12	
Beech Subcontractors potential weight reduction	-6	

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~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESSERVICE MODULEELECTRICAL POWER - CONTINUED

Reduce H ₂ for 10 day mission in lieu of 14 day.	-7
Reduce O ₂ for 10 day mission in lieu of 14 day.	-185
Decrease in Fuel Cell Power System, based on Pratt & Whitney's weight report reflecting the following:	-38
Compact Secondary Regenerator	-7
Unitized Gas Manifolds	-6
Close control of electrode filling techniques	-10
Thinner electrode spacing	-15
Increase chem-milled area, thinner, sections and reduced area on space radiators.	-14

MAIN PROPULSION

(-12)

Redesign main propellant internal tank supports for a reduced gauge.	-12
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TOTAL POTENTIAL WEIGHT CHANGES - SERVICE MODULE

-321~~CONFIDENTIAL~~

~~CONFIDENTIAL~~POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGESADAPTER

Increase structure due to the following: +400

Core density increase in honeycomb panels and
addition of densified core around panel joints. +300

NASA responsible changes for providing bumps where
LEM configuration protrudes through the conical
section of the adapter. +100

Increase structure due to changing landing gear pad radius from
164 inches to 180 inches per NASA direction. +300

TOTAL ADAPTER POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES +700

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULESUMMARY

ITEM		CURRENT WEIGHT 8-1-63
<u>WEIGHT EMPTY</u>		7811
Structure	4481	
Crew Systems	320	
Communication & Instrumentation	747	
Guidance & Navigation	478	
Stabilization & Control	209	
Reaction Control	290	
Electrical Power	427	
Environmental Control	292	
Earth Landing	567	
<u>USEFUL LOAD</u>		1589
Crew Systems	917	
Reaction Control	259	
Environmental Control	163	
Scientific Payload	250	
GROSS WEIGHT		9400

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DETAIL WEIGHT STATEMENT
COMMAND MODULE
STRUCTURE

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ITEM

CURRENT
WEIGHT
8-1-63STRUCTURE

Basic Body Structure		(1030)
Forward Section		172
Honeycomb	56	
Frames, Rings and Hatches	57	
Fittings and Attachments	59	
Center Section		665
Honeycomb Panels	207	
Longerons, Frames and Rings	262	
Window and Hatches	107	
Fittings and Attachments	89	
Aft Section		193
Honeycomb Panel	116	
Ring	77	
Secondary Structure		(548)
RH Equipment Bay and Coldplates		81
LH Equipment Bay		60
Fwd. LH Equipment Bay		15
Fwd. RH Equipment Bay and Coldplates		26
Main Display Panel and Coldplates		73
Lower Equipment Bay and Coldplates		199
Aft Equipment Bay		44
Crew Area		25
Heat Shield Equipment Area		25
Heat Shield Substructure		(1407)
Forward Section		207
Honeycomb Panels	105	
Frames and Rings	27	
Fittings and Mechanism	50	
Strake	25	
Center Section		697
Honeycomb Panels	233	
Frames and Rings	104	
Doors and Covers	198	
Fittings, Mechanism and Attachments	109	
Strake	53 ^A	
Aft Section		503
Honeycomb Panels	355	
Frames and Rings	47	
Fittings and Attachments	61	
Toroidal Assembly	40	
Ablation Material		(1277)
Forward Section		139
Center Section		540
Aft Section		598
Insulation		(195)
Separation Provisions and Attachments		(24)
TOTAL STRUCTURE		4481

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULECREW SYSTEMS

ITEM	CURRENT WEIGHT 8-1-63
<u>CREW SYSTEMS</u>	
Crew Couch Support and Restraint System	30.0
Waste Management	15.0
Lighting Equipment	10.3
Egress Accessories - Hatch	3.0
Case Assembly - Map and Manual	2.0
Structural Seats and Supports	258.0
Shelf Assy. - Work/Food Preparation	<u>1.7</u>
 TOTAL CREW SYSTEMS	 320.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULECOMMUNICATIONS AND INSTRUMENTATION

ITEM	CURRENT WEIGHT 8-1-63
<u>TELECOMMUNICATION</u>	
Lower Bay	(305.2)
C-Band Transponder	20.8
Unified S-Band	25.0
S-Band Power Amplifier	20.5
VHF FM Transmitter/HF Transceiver	15.9
VHF AM Trans. -Rec/VHF Rec. Bea.	14.0
Multiplexer	11.6
Spares	19.0
PCM Telemetry Unit No. 1	26.2
PCM Telemetry Unit No. 2	20.8
Signal Conditioner	32.8
Recorder	25.4
Audio Center	8.0
Premodulation Processor	11.2
Central Timing Equipment	8.0
Up Data Link and Provisions	35.0
Nuclear Radiation Detector Equipment	11.0
Remote Equipment	(87.8)
HF Recovery Antenna & Transmission	6.0
C-Band Antenna & Transmission	11.3
VHF Recovery Antenna & Transmission	6.3
TV Camera	5.0
Instrumentation Sensors	35.0
Nuclear Radiation Detectors	6.0
VHF Scimitar Antenna and Transmission	6.9
2-KMC Scimitar Antenna and Transmission	8.1
2-KMC High Gain Antenna, Transmission and Switch	3.2
Electrical Provisions	<u>(95.0)</u>
TOTAL TELECOMMUNICATIONS (to be brought forward)	488.0

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DETAIL WEIGHT STATEMENT
COMMAND MODULE
COMMUNICATION AND INSTRUMENTATION

CURRENT
WEIGHT
8-1-63

ITEM

CONTROLS AND DISPLAYS

Main Display Panel Control Station	(40.8)
Mode Select	6.9
Delta Velocity	2.5
Flight Director Attitude Indicator	10.5
Attitude Set and Gimbal Position Display	6.0
Entry Monitoring Indicator	8.0
Launch Vehicle Emergency Detection System	3.6
Master Caution and Abort Lt.	.3
SCS Power Control	1.1
IFTS Switch & Barometric Indicator	1.9
Main Display Panel Center Station	(61.2)
Audio Panel	1.7
Abort Light	.2
Reaction Control	8.2
GMT Readout	5.0
ECS Gages and Controls	8.5
Crew Safety Controls	1.8
High Gain Antenna Control	3.0
G & N Computer Keyboard	15.0
Radiation Displays	3.0
Cryogenics	6.5
VHF Antenna Coax Switch	.4
Caution and Warning Display	7.5
Barometric Valve Switch	.4
Main Display Panel System Management Station	(27.0)
Communications Control Panel	7.3
Caution Lights	.3
Power Distribution	6.9
Fuel Cells	4.3
Service Propulsion	8.1
IFTS Switch	.1
Main Display Panel RH Console	(6.4)
Motor Control Switches	3.6
Audio Panel	1.7
Lighting Control	1.1
Main Display Panel LH Console	(3.7)
Sequencer Arming & Post Landing Control	.9
Lighting Control	1.1
Audio Panel	1.7
Electrical Provisions	(29.3)
Lower Equipment Bay	(1.6)
Clock	.8
Event Timer	.8

TOTAL CONTROLS AND DISPLAYS (to be brought forward)

170.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULECOMMUNICATION AND INSTRUMENTATION

ITEM	CURRENT WEIGHT 8-1-63
INFLIGHT TEST (RIGHT BAY FORWARD)	(89.0)
Comparator & Power Supply	34.5
Lamps	4.0
Switches	1.4
Meter	1.0
Chassis	8.1
Inflight Test - GSE Electrical Provisions	40.0
	<hr/>
TOTAL INFLIGHT TEST	89.0
TOTAL CONTROLS AND DISPLAYS	170.0
TOTAL TELECOMMUNICATION	488.0
	<hr/>
TOTAL COMMUNICATIONS AND INSTRUMENTATION	747.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEGUIDANCE & NAVIGATION

ITEM	CURRENT WEIGHT 8-1-63
<u>GUIDANCE AND NAVIGATION</u>	
Lower Equipment Bay	
Inertial Platform	59.0
Sextant	12.0
Telescope - Scanning	9.0
Map & Visual Display	8.5
Display & Control - Navigation	25.7
Display & Control - Computer	15.0
Navigation Base	27.2
Computer	97.0
Power Servo Assy	54.7
Coupling Display Unit	16.5
Junction Box	12.2
Cabling - MIT	25.0
Cabling - NAA	16.0
Spares	52.0
Optical Base	21.0
Eye Pieces	3.8
Bellows and Adapter	13.9
Loose Stored Items	9.5
<hr/>	
TOTAL GUIDANCE AND NAVIGATION	478.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULESTABILIZATION AND CONTROL

ITEM	CURRENT WEIGHT 8-1-63
<u>STABILIZATION AND CONTROL</u>	
Lower Equipment Bay	(178.0)
Rate Gyro Package	6.5
Body Mounted Gyro Package	10.5
Electronic Control Package - Pitch	28.4
Electronic Control Package - Roll	29.1
Electronic Control Package - Yaw	28.4
Electronic Control Package - Auxiliary	30.5
Display/BMAG ECA Package	29.8
Spare Gyro - BMAG (2)	2.0
Spare Gyro - Rate	0.8
Spare Plug-in Module	12.0
Crew Area Controls	(15.0)
Manual Controls - 3 Axis	7.0
Manual Controls - Translation & Thrust	8.0
Electrical Provisions	(16.0)
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TOTAL STABILIZATION AND CONTROL	209.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEREACTION CONTROL SYSTEM

ITEM	CURRENT WEIGHT 8-1-63
<u>REACTION CONTROL SYSTEM</u>	
Propellant Systems	(73.8)
Oxidizer System	36.8
Tanks & Expulsion Devices	14.6
Plumbing, Fittings & Insulation	11.4
Valves & Regulators	10.3
Sensors	.5
Fuel System	37.0
Tanks & Expulsion Devices	14.8
Plumbing, Fittings & Insulation	11.4
Valves & Regulators	10.3
Sensors	.5
Pressure System	(55.2)
Tanks (4500 psi)	9.5
Plumbing, Fittings & Insulation	4.8
Valves & Regulators	38.4
Sensors	2.5
Engine System	(138.0)
Engines	96.0
Nozzle Extension	42.0
Electrical Provisions	<u>(23.0)</u>
TOTAL REACTION CONTROL SYSTEM	290.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEELECTRICAL POWER

ITEM	CURRENT WEIGHT 8-1-63
<u>ELECTRICAL POWER</u>	
Energy Source	(64.0)
Battery - Re-entry (2)	36.0
Battery - Post Landing (1)	18.0
Battery - Pyrotechnic - Installation	10.0
Power Conversion	(114.0)
Inverter (3) & Control	108.0
Battery Charger & Controls	5.0
PLSS Battery Charging System	1.0
Power Distribution & Control	(92.4)
D-C Power Panel Assy	8.6
A-C Power Box Assy	11.1
Battery Circuit Breaker Panel	1.0
Lower Equipment Bay Panel	5.1
Terminal Distribution Panel (Bus)	9.0
Circuit Breaker Panel	4.0
Electrical Transmission (Wiring, Connectors, Cond., Sup.)	34.6
Ground Power Provisions	6.0
Power Control Panel Connectors	3.0
Installation Provisions	10.0
Electrical Common Utility	(156.6)
Electrical Transmission (Wiring, Conn., Cond., & Sup.)	74.9
Right Hand Circuit Breaker Panel	13.0
Left Hand Circuit Breaker Panel	5.4
Lighting	5.0
Adapter Separation System	5.0
LEM Separation System	3.5
S/M Pyrotechnic Initiation	3.0
Circuit Utilization Package	12.8
Sequencer	20.0
Installation Provisions	14.0
TOTAL ELECTRICAL POWER	427.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT 8-1-63
<u>ENVIRONMENTAL CONTROL SYSTEM</u>	
Pressure Suit Circuit	(89.6)
Subcontractor Compressor, Heat Exchg., Val. & Cont.	74.8
Ducting, Conn., Clamps, etc.	12.8
CO ₂ Sensor	2.0
Water-Glycol Circuit	(58.9)
Subcontractor Res., Evaporator, Pump, Val. & Cont.	28.0
Water-Glycol	18.4
Plumbing, etc.	12.5
Pressure & Temp. Control	(18.8)
Subcontractor Heat Exchg., Blower, Val. & Cont.	18.0
Ducting	0.8
Oxygen Supply System	(15.3)
Subcontractor Entry O ₂ Sys., Val. & Cont.	5.0
Plumbing	4.0
Oxygen Surge Tank	6.3
Water Supply System	(39.3)
Subcontractor Potable & Waste Tanks & Freon Tank	27.7
Plumbing	11.6
Subcontractor Common Items	(32.2)
Brackets, Plumbing, Elect. Wiring	12.3
Instrumentation	15.8
Radio Noise Filter Spec. Allowance	4.1
Supports	(13.3)
Electrical Provisions	(21.0)
Manual Controls - Push Pull	<u>(3.6)</u>
TOTAL ENVIRONMENTAL CONTROL SYSTEM	292.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEEARTH LANDING SYSTEM

ITEM	CURRENT WEIGHT 8-1-63
<u>EARTH LANDING SYSTEM</u>	
Parachute System	(531.2)
Drogue Chute System	35.5
Main Cluster	419.0
Disconnect Main Cluster	4.0
Pilot Chute System	29.3
Sequence Control	10.7
Attach Provisions	32.7
Location Aids	(10.0)
Forward Heat Shield Release System	(15.8)
Drogue Disconnect Installation	(5.0)
Electrical Pyrotechnic Initiation Provisions	<u>(5.0)</u>
TOTAL EARTH LANDING SYSTEM	567.0

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DETAIL WEIGHT STATEMENTCOMMAND MODULEUSEFUL LOAD

ITEM	CURRENT WEIGHT 8-1-63
<u>CREW SYSTEMS</u>	(917.0)
Crew (3) (50, 70, 90 Percentile)	528.0
Pressure Garment Assy (3) (NASA)	90.0
Food	75.0
Food Containers	15.0
Personal Hygiene Equipment	15.5
Biomedical Instrumentation (NASA)	2.0
Medical Equipment	15.3
Waste Management	6.9
Personal Radiation Dosimeter (NASA)	5.0
Shoe Straps	2.0
Garments - Constant Wear (NASA)	9.0
Hose Assembly-Umbilical	17.9
Hose Assembly-Recharging Backpack	2.8
Belt Assy Inflight Maintenance, Crewman	1.0
Map & Maintenance Manual	4.0
Log Book Assy	1.0
Lap Board Assy	2.0
Tool Set Inflight Maintenance	1.0
Portable Life Support System (NASA)	60.0
Personal Communications	3.0
Mouthpiece - Food, Personal	2.0
Delivery Assy - Water, Personal	1.5
Provision Assy - Crewman Survival (Collective)	56.1
Light Assembly - Portable	1.0
<u>REACTION CONTROL</u>	(259.0)
RCS Propellant	258.0
Usable	215.0
Residual	43.0
Trapped - System	30.6
Mixture Ratio	2.4
Expulsion Efficiency	7.6
Loading Tolerance	2.4
RCS Helium	1.0
<u>ENVIRONMENTAL CONTROL</u>	(163.0)
Lithium Hydroxide	112.0
Activated Charcoal	4.0
Containers for LiOH & Charcoal	12.5
Oxygen - Re-entry	3.7
Freon	10.0
Water-Earth Orbit Cooling & Drinking	4.0
Water-Boost Cooling	4.0
Water-Emergency Re-Entry Cooling	6.0
Water-PLSS Initial Charge	6.8
<u>SCIENTIFIC PAYLOAD</u>	(250.0)
TOTAL COMMAND MODULE USEFUL LOAD	1589.0

~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULESUMMARY

ITEM		CURRENT WEIGHT 8-1-63
<u>WEIGHT EMPTY</u>		7495
Structure	2290	
Electronics	177	
Reaction Control	590	
Electrical Power	1332	
Environmental Control	99	
Propulsion	3007	
<u>USEFUL LOAD</u>		2230
Reaction Control	838	
Electrical Power	503	
Environmental Control	208	
Propulsion	681	
BURNOUT WEIGHT		9725
MAIN PROPELLANT		37400
GROSS WEIGHT		47125

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULESTRUCTURE

ITEM	CURRENT WEIGHT 8-1-63
STRUCTURE	
Basic Body Structure	(1644)
Honeycomb Panels - Shell	762
Radial Beams	380
Internal Structure and Eng. Compt. Closeout	43
Forward Bulkhead	155
Aft Bulkhead	304
Secondary Structure	(234)
Tank Support Shelf	33
Engine Support	41
Antenna Support	30
Heat Shields	130
Insulation	(253)
Separation Provisions and Attach	(16)
Fairing	(143)
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TOTAL STRUCTURE	2290
	283
	<hr/> 2037

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEELECTRONIC SUBSYSTEM

ITEM	CURRENT WEIGHT 8-1-63
<u>ELECTRONICS SUBSYSTEM</u>	
Communications	(48)
High Gain Antenna	29
Antenna	12.2
Gimbals	12.0
Earth Sensor	4.8
Antenna Boom	7
Antenna Locking Provisions	3
Coax	5
Coax Connectors	1
Supports	1
Wiring	2
Instrumentation	(129)
Sensors	30
Electrical Provisions	94
Supports	<u>5</u>
TOTAL ELECTRONICS SUBSYSTEMS	177

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEREACTION CONTROL

ITEM	CURRENT WEIGHT 8-1-63
<u>REACTION CONTROL SYSTEM</u>	
Propellant Systems	(149.0)
Oxidizer System	74.3
Tanks & Expulsion Devices	28.8
Plumbing, Fittings & Insulation	8.5
Valves & Regulators	16.0
Sensors	3.0
Supports	18.0
Fuel System	74.7
Tanks & Expulsion Devices	29.2
Plumbing, Fittings & Insulation	8.5
Valves & Regulators	16.0
Sensors	3.0
Supports	18.0
Pressure System	(128.0)
Tanks (4500 psi)	19.0
Plumbing, Fittings & Insulation	6.0
Valves & Regulators	76.0
Sensors	7.0
Supports	20.0
Engine System	(175.0)
Engines	65.0
Reflectors & Insulation	110.0
Structural Provisions	(80.0)
Electrical Provisions	<u>(58.0)</u>
TOTAL REACTION CONTROL SYSTEM	590.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEELECTRICAL POWER

ITEM	CURRENT WEIGHT 8-1-63
<u>ELECTRICAL POWER</u>	
Fuel Cell Power System	(1170.7)
Fuel Cell Power Pack (Incl. Mount Instrumentation)	764.2
Intermodular - Radiator Plumbing	16.0
Fuel Cell Module Mount Attach	2.0
Fuel Cell H ₂ System	
Subcontractor Components	137.6
Plumbing and Valves	3.0
Fuel Cell and ECS O ₂ System	
Subcontractor Components	166.9
Plumbing and Valves and Supports	22.0
Water Glycol - Fuel Cell Heat Transfer System	7.0
Elect. Wiring - Supercritical Gas	10.0
Space Radiator (Outer Skin)	38.2
Fuel Cell Module Stabilization Webs	3.8
Power Distribution	(72.0)
Electrical Transmission	40.0
Power Distribution Box	32.0
Electrical Common Utility	(89.3)
Electrical Transmission	47.4
Sequencer	8.0
Adapter Separation System	7.0
C/M to S/M Separation System	5.0
Pyrotechnic Initiation	12.0
Provisions	9.9
 TOTAL ELECTRICAL POWER	 1332.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT 8-1-63
<u>ENVIRONMENTAL CONTROL SYSTEM</u>	
Water-Glycol Circuit	(86.9)
Subcontractor Valves & Controls	5.6
Plumbing and Hardware	16.8
Water - Glycol	10.0
Supports	5.0
Space Radiator (Outer Skin)	49.5
Water Supply System	(7.1)
Subcontractor Valves & Controls	.1
Plumbing and Hardware	6.0
Supports	1.0
Oxygen Supply System	(3.0)
Plumbing and Supports	3.0
Common Items	(2.0)
Supports	<u>2.0</u>
TOTAL ENVIRONMENTAL CONTROL SYSTEM	99.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEMAIN PROPULSION

ITEM		CURRENT WEIGHT 8-1-63
<u>MAIN PROPULSION</u>		
Propellant Systems		(1376.0)
Oxidizer System		765.3
Tanks & Doors	551.0	
Skirts	59.8	
Plumbing, Fittings & Insulation	53.0	
Valves	4.5	
Quantity Indication	35.0	
Mixture Ratio Control	12.0	
Supports - Plumbing & Equipment	50.0	
Fuel System		610.7
Tanks & Doors	458.0	
Skirts	33.2	
Plumbing, Fittings & Insulation	42.0	
Valves	4.5	
Quantity Indication	35.0	
Supports - Plumbing & Equipment	38.0	
Pressure System		(915.0)
Tanks (4400 psi)		774.0
Tank Supports		30.0
Plumbing, Fittings & Insulation		24.0
Valves, Regulators & Heat Exchanger		49.0
Supports - Plumbing & Equipment		38.0
Engine System		(690.0)
Engine		690.0
Electrical Provisions		<u>(26.0)</u>
TOTAL MAIN PROPULSION SYSTEM		3007.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULEUSEFUL LOAD

ITEM	CURRENT WEIGHT 8-1-63
REACTION CONTROL	(838.0)
RCS Propellant	835.0
Usable	790.0
Residual	45.0
Trapped System	4.0
Mixture Ratio	9.0
Expulsion Efficiency	24.0
Loading Tolerance	8.0
RCS Helium	3.0
ELECTRICAL POWER (Normal Mission)	(503.0)
Hydrogen - Supercritical Gas	58.5
Usable (Electrochemical Incl. Tolerance)	46.0
Unusable (Residual & Instrument Error)	3.2
Emergency Provisions	4.7
Expend (Leakage & Purge)	4.6
Oxygen - Supercritical Gas	444.5
Usable (Electrochemical Incl. Tolerance)	377.0
Unusable (Residual & Instrument Error)	17.5
Emergency Provisions	44.0
Expend (Leakage & Purge)	6.0
ENVIRONMENTAL CONTROL (Normal Mission)	(208.0)
Oxygen - Supercritical Gas	208.0
Usable (Metabolic)	76.5
Unusable (Residual & Instrument Error)	9.1
Emergency Provisions	25.3
Expend (Leakage, LEM, PLSS, Repress.)	97.1
PROPULSION	(681.0)
Main Propulsion Helium	99.0
Main Propellant Residuals	582.0
Trapped - System	225.0
Trapped - Engine	67.0
Mixture Ratio Tolerance	100.0
Loading Tolerance	190.0
TOTAL USEFUL LOAD (Less Main Propellant)	2230.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTLAUNCH ESCAPE SYSTEMSUMMARY

ITEM	CURRENT WEIGHT 8-1-63
<u>LAUNCH ESCAPE SYSTEM</u>	
Structure	(1011)
Tower Assy	302
Escape Motor Skirt	229
Pitch Motor Structure	157
Nose Cone and Ballast Support	106
Attaching Parts	25
Tower Insulation	182
Skirt Insulation	10
Ballast	(203)
Propulsion	(5345)
Escape Motor	4764
Jettison Motor	434
Jettison Motor Skirt	92
Pitch Control Motor	55
Electrical Power	(41)
TOTAL LAUNCH ESCAPE SYSTEM	<hr/> 6600

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTADAPTERSUMMARY

ITEM	CURRENT WEIGHT 8-1-63
<u>ADAPTER</u>	
Structure	(2892)
Panels	1914
Frames	422
Thermal Insulation	556
Electrical Power	(76)
Separation System	(142)
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TOTAL ADAPTER	3110

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